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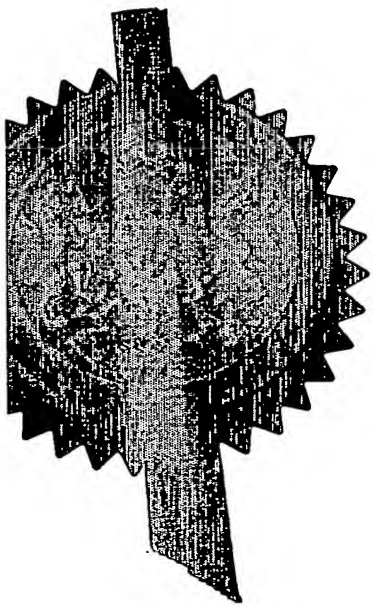

Signed Stephen Hordley

Dated 2 July 2003

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1/77

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P01/7700 0.00-0213948.3

Request for grant of a patent

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1.	Your reference	JDM/DGR/P407378GB
2.	Patent application number *(The Patent Office will fill in this part)*	0213948.3 — 18 JUN 2002
3.	Full name, address and postcode of the or of each applicant (*underline all surnames*)	**AWAZEL WATERPROOFING COMPANY.,** P.O.Box 2955, Riyadh, 11461, Kingdom of Saudi Arabia.
	Patents ADP number (*if you know it*)	
	If the applicant is a corporate body, give the country/state of its incorporation	KINGDOM OF SAUDIA ARABIA 8400605001
4.	Title of the invention	METHOD AND APPARATUS FOR EXTRACTING HYDROCARBON MATERIAL
5.	Name of your agent (*if you have one*)	**W. P. THOMPSON & CO.**
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	Coopers Building, Church Street, Liverpool L1 3AB
	Patents ADP number *(if you know it)*	0000158001

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(Day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application		Number of earlier application	Date of filing *(Day/month/year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'yes' if:* *a) any applicant named in part 3is not an inventor, or* *b) there is an inventor who is not named as an applicant, or) any named applicant is a corporate body.* *See note (d)*	YES		

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Continuation sheets of this form	
Description	9
Claims(s)	
Abstract	
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Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *Patents Form 10/77*)	
Any other documents *(Please specify)*	

11. I/We request the grant of a patent on the basis of this application

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Date 17/06/2002

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DESCRIPTION

METHOD AND APPARATUS FOR EXTRACTING HYDROCARBON MATERIAL

The present invention relates to a method and apparatus for extracting usable hydrocarbon material from waste products.

Presently sludges comprising settled solids of hydrocarbons, such as asphaltenes and waxes, and inorganic solids such as sand, scale or barite, which have been removed from oil tanks and other like storage facilities are dumped on sites such as waste land or in land pits. Such sites present major management and environmental problems owing to the high oil content of the sludges. Such sludges are toxic and hazardous to health. In countries which operate high environmental standards, for example member countries of the European Union and the USA, landfill is not a viable option. Consequently, such sludges are held in storage until a suitable permanent disposal method can be found.

Such landfill sites are in excess of 100m square and 4m deep. In developed economies there are stringent restrictions on how and where waste can be processed, especially when classified as hazardous to health.

In less developed countries, such as those of the Middle East, where a more relaxed view is taken of environmental issues, this waste is spread over a land mass to allow weathering, i.e evaporation and washing away, to take place without regard to the consequences. In the Middle East this process is referred to as land farming.

In any event such sludges present a major management and environmental problem.

These sludges may however contain hydrocarbons that are useful, for example they may contain hydrocarbons, such as bituminous material, which have long been known as a suitable material for use in the formation of surfaces (e.g. the surface layers or roadbase of flexible pavement or road structures) for city streets, highways, airfields and other construction applications as well as a water-repellent barrier for use in e.g. buildings.

It would be useful, for example to recover bitumen from sludges. Such bitumen is a finite source obtained from naturally occurring sources or pyrolytically obtained from natural oil. It has been well documented that within the next century it is believed that our natural oil reserves will expire.

It would therefore be advantageous to provide an alternative source of hydrocarbon materials e.g. bitumen, and at the same time alleviate problems associated with sludge disposal.

In accordance with a first aspect of the present invention there is provided a method for extracting hydrocarbons from waste material comprising the steps of:

i) identifying waste material with an economically valuable or environmentally hazardous concentration of hydrocarbons;

ii) treating the waste material to render the hydrocarbons more susceptible to extraction;

iii) extracting the hydrocarbons from the waste material;

iv) optionally further processing the extracted hydrocarbons into a usable product.

The concentration of hydrocarbons within the waste material is preferably

more than 20% hydrocarbon oil by volume.

The treatment of the waste material to render the hydrocarbons more susceptible to extraction may be performed by a number of methods. Preferably, the treatment means is by the use of heat and/or solvents.

In accordance with a further aspect of the present invention there is provided a method for extracting hydrocarbons from solid waste material comprising the steps of:

i) mixing the solid waste material with a solvent;

ii) extracting the majority of the hydrocarbons from the mixture;

iii) heating the remaining waste hydrocarbons in the mixture to a temperature of at least 40^0C;

iv) extracting the remaining waste hydrocarbons;

v) optionally further processing the extracted hydrocarbons into a usable product.

In accordance with another aspect of the present invention there is provided a method for extracting hydrocarbons from sludge comprising the steps of :

i) heating the waste hydrocarbons to a temperature of at least 40^0C;

ii) extracting the majority of the hydrocarbons;

iii) mixing the remaining waste hydrocarbons with a solvent;

iv) extracting the remaining waste hydrocarbons;

v) optionally further processing the extracted hydrocarbons into a usable product.

In accordance with further aspect of the present invention there is provided

a method for extracting hydrocarbons from sludge comprising the steps of:

i) identifying sludge comprising more than 20% hydrocarbons by volume;

ii) heating said waste hydrocarbons to a temperature of at least 40^{0}C;

iii) extracting said heated waste hydrocarbons;

iv) optionally further processing the extracted hydrocarbons into a usable product.

A variety of methods used to identify sludge comprising more than 20% hydrocarbons by volume may be employed, for example solvent extraction, heat extraction, gas chromatography, mass spectrometry and infra red spectrometry may be used.

The present invention allows the sludge to be collected for use as a raw material. This can then be processed as fluxent oil to be mixed with bitumen during the oxidisation process into bitumen and the like.

The sludge used may contain contaminants e.g. aggregate.

Preferably, the hydrocarbons are heated to a temperature of 40 -90^{0}C. More preferably, the hydrocarbons are heated to a temperature 65-75^{0}C.

Preferably, the average percentage of hydrocarbons by volume in the sludge starting material is at least 50%.

In accordance with a further aspect of the present invention there is provided an apparatus for extracting recyclable hydrocarbons from waste hydrocarbons contaminated with aggregate comprising:

means for heating said hydrocarbons to a temperature of at least 40°C and means for extracting and/or transferring said heated waste hydrocarbon to a storage means.

Preferably the waste hydrocarbons are heated to a temperature in the range of 40 - to 90°C, more preferably, to a temperature on the range 65 - 75°C.

The means for heating may comprise a coil or a bank of tubes having a circulating liquid of thermal oil/vapour/gas or electric elements. Preferably the heating means comprise oil filled tubes.

Preferably, the hydrocarbon is heated to a depth of between 20cm - 60 cm from the upper surface of the sludge, more preferably, 40 - 45cm.

The heater may be directed by immersing the heater in the sludge or directing the heat by blowers or by other directional device. Preferably, the heater is immersed in the sludge. The heater may also be placed in an area or a discrete part of the sludge to enable localised hydrocarbon extraction.

The method may be used on waste material such as asphalt, bitumen, heavy fuel oil, crude oil, animal fats, vegetable oil. Preferably, it is used on bitumen.

In accordance with yet a further aspect of the present invention there is provided a method for extracting hydrocarbons from solid waste material comprising the steps of:

i) mixing the solid waste material with a solvent;

ii) extracting the hydrocarbons from the mixture;

iii) optionally further processing the extracted hydrocarbons into a usable product.

The solid waste material may comprise lumps of bitumen, asphaltenes and compacted oily sand.

The solvent may comprise of one or more solvents selected from an aqueous solvent, a non-aqueous solvent or water.

Preferably, the steps of contacting the solid material with water and mixing with a solvent is performed in a treatment area, which may comprise an excavation lined with an impermeable barrier. Such impermeable barriers may be constructed out of concrete or polythene.

The solvent used in extracting the hydrocarbons from the solid waste material is preferably an orange oil derivative. Other solvents such as aliphatic hydrocarbon, aromatic hydrocarbon and chlorinated solvents, may also be used.

Preferably, the mixing of the solid material, water and solvent is by means of a trommel; a rotating drum, an Archimedes screw, a paddle mixer, a spray bar over moving conveyor, a screen or an attrition scrubber. Those skilled in the art will realise that the exact device used will be dictated by the volume of the waste matter being treated.

The means by which the hydrocarbons may be separated from the water may comprise a rotating disc or floating head skimmer.

A specific example of the present invention will now be described, by way of example only, with reference to accompanying figure, which is a process diagram of the method for extracting hydrocarbon material from liquid and solid phase waste.

EXAMPLE 1

The method for extracting hydrocarbon material from sludge in the liquid phase is as follows.

With reference to figure 1, the heater 1 is immersed in the sludge in a dedicated sludge pit 2. The heater in this example covers an area of 6 m^2 and can be a standard thermal oil heater. The heater comprises a continuously shaking coil 3, filled with thermal oil. The diameter of the coil is typically about 5 cm, although a coil in the range of 1.25 cm to 10.25 cm could also be used. The sinuosity of the coils is approximately 25cm, but a coil with sinuosity in the range of 10cm to 50cm would also be acceptable. The heating temperature will depend upon the hydrocarbon concentration within the sludge.

A suction hose is laid above the heater coil, the diameter of the suction hose typically being about 10 cm in diameter. The size of the suction hose ensures that there is heat transfer into the hose, thereby keeping the sludge warm and mobile. In this regard, the suction hose may alternatively have a diameter in the range of 5 cm to 16 cm. The suction hose is connected to a displacement gear pump 4 for viscous materials which will typically be a diaphragm or a centrifugal pump.

A delivery pipe from the pump 4 feeds directly into the top of a heated tanker 5 for transport to a processing plant 6, where the recovered material is blended with hot bitumen and is then converted by standard means into waterproofing membrane or other such products or materials.

The liquid remaining in the sludge pit 2 may still contain a low quantity of hydrocarbons and can be processed further by pumping the liquid to a separation tank 8, via pump 7. The separation tank will separate water from hydrocarbons either over

time or by heating and the hydrocarbons can then be moved to the heated tanker 5 for transport to a processing plant 6. The remaining water would contain a very low concentration of hydrocarbons and thus may deemed to be within a safe environmental limit. In this instance, the water may be allowed to evaporate in an evaporation pond 9.

EXAMPLE 2

The method for extracting hydrocarbon material from solid phase/material is as follows.

With reference to figure 1, the solid phase, which may comprise lumps of bitumen, asphaltenes and compacted oily sand 10 are skimmed off by front loader or excavator 12 down to the level where contamination levels are within acceptable levels. The materials are then transferred to a treatment area 14 by means of a dumper truck 13. A treatment area 14 may be an excavation lined with an impermeable barrier such as concrete or polythene which will be half filled with water.

The oily matter is mixed with a suitable solvent, such as a solvent with a main active ingredient being an orange oil derivative. Other solvents such as aliphatic hydrocarbon, aromatic hydrocarbon and chlorinated solvent, may also be used.

The solvent is then mixed with the oily matter. This can be achieved by a number of devices such as a trommel; a rotating drum, an Archimedes screw, a paddle mixer, a spray bar over moving conveyor, a screen, or an attrition scrubber, the exact device used is dictated largely on the volume of the waste matter being

treated.

With the solvent types listed above, the oil/solvent will have a tendency to settle on top of the water. The exception is the chlorinated type where the solvent/oil will be heavier than water and this solvent may require additional processing steps which are not outlined in this example.

The waste matter containing the solvent is then pushed through the water in the treatment area by an Archimedes screw, to enable thorough mixing with the water.

Periodically, the process is halted to allow for separation of the oil from the water. At this point the free oil would be skimmed from the surface by means of a rotating disc or floating head skimmer and transferred directly to tankers for transfer to the manufacturing plant 6 for further processing (as described in example 1).

If the original material contained sand, the cleaned sand can then be excavated from the containment area and held for eventual return to the original site for further processing or disposal.

Alternatively, the cleaned sand 11 can be further cleaned by using the sludge pit 2, in the process outlined in example 1. This process can also be used if the sand 10 has a low concentration of hydrocarbons and the process of using the sludge pit 2 would be more effective than using a sand treatment area 14.

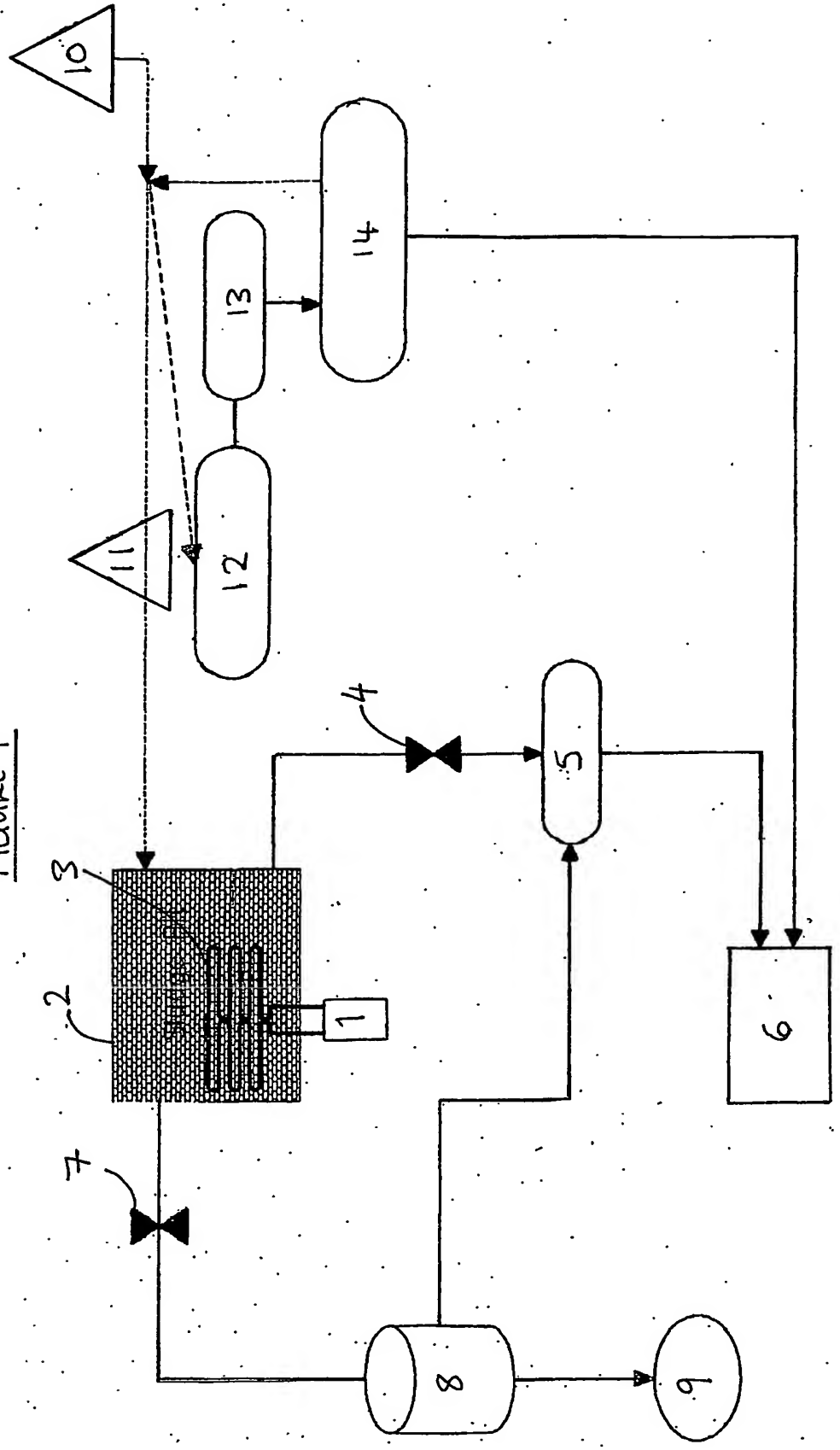

FIGURE 1